



Airspace Systems Program Newsletter

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// Program Director's Letter

Dear Colleague,

Please join us!

NASA's Airspace Systems Program will host an Industry Day and Technical Interchange Meeting (TIM) to facilitate the discussion of key research and development issues for the Next Generation Air Transportation System (NextGen).

Come join us in these discussions from April 30-May 2, 2013.

Our two projects, NextGen Concepts and Technology Development and NextGen Systems Analysis, Integration and Evaluation, and our partners will share highlights of their research. This forum will provide the opportunity to present recent developments and results, to participate in open technical exchange, and to solicit your feedback to enhance the program. For more information regarding the Airspace Systems Program and its projects, please visit the aeronautics website: <http://www.aeronautics.nasa.gov>.

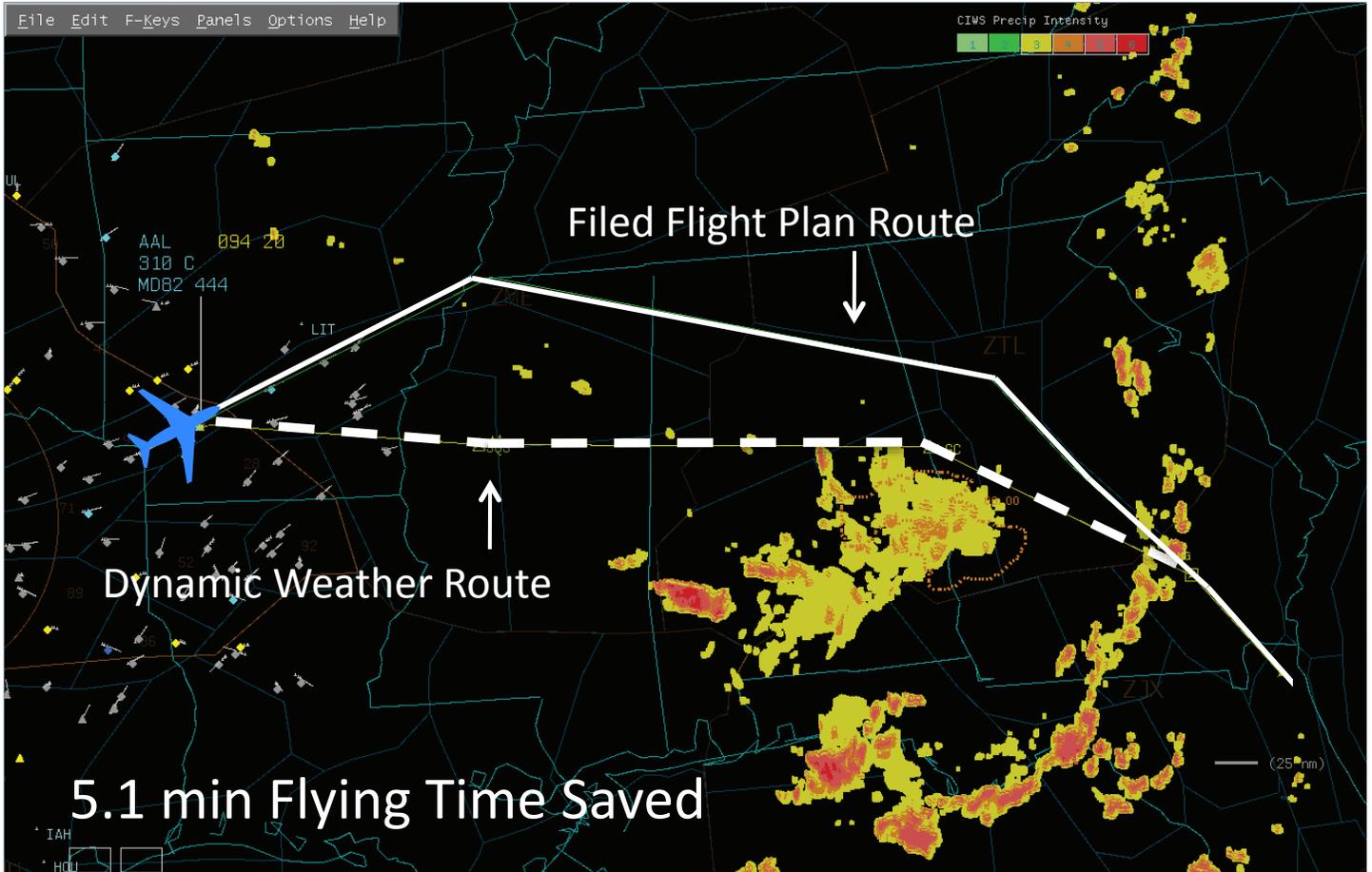
The meeting will be held in Building 152 at the Ames Research Center, Moffett Field, Northern California's Silicon Valley. Additional details about the venue and agenda for the Industry Day and Technical Interchange Meeting will be available in the next few weeks on our website, which will be updated regularly: http://www.aeronautics.nasa.gov/programs_asp.htm. The forum will include plenary sessions, discussion panels, demonstrations and parallel technical tracks examining the full range of NextGen research.

If you have questions regarding event logistics, please contact Mr. Barry Sullivan, ASP Technical Integration Manager, via email at barry.t.sullivan@nasa.gov or phone (650-604-6756).

I look forward to seeing you this coming spring!

John Cavolowsky
Program Director, Airspace Systems Program

// Technical/Programmatic Highlights



Dynamic Weather Route user interface showing a reroute issued to an American Airlines flight on July 31, 2012.

DWR Briefing to Joint FAA/Industry DCIT, April 2012

Dave McNally presented the Dynamic Weather Routes (DWR) concept and analysis results at the joint Federal Aviation Administration (FAA)/Industry Data Communications Implementation Team (DCIT) monthly meeting in Washington, DC. The DCIT is focused on near-term applications for today's air/ground data communications (data comm). With

a current emphasis on departure clearance messages, they expressed interest in DWR-like technology for en route trials planned for 2014. McNally was invited by DCIT industry co-lead Rob Mead of Boeing, and co-presented the DWR brief with Captain Rick Shay of United Airlines. Shay, a long-standing active member of the DCIT, demonstrated strong support for the DWR concept, helped answer many detailed questions from the group. Approximately fifty members attended the meeting in person or via telecom—including airline

representatives from United, American, FedEx, and Delta—and indicated strong support for the concept. (POC: *Dave McNally*)

Aviation Systems Division Intern Wins NASA Aeronautics Scholarship, April 2012

Brian Andrade, a freshman at San Jose State University and a 2011 summer intern in the Aviation Systems Division at NASA's Ames Research Center, has won a prestigious NASA Aeronautics Scholarship. Only 25 out of the 300 applicants were awarded this two-year scholarship. The scholarship provides \$15K tuition support per year and a \$10K summer internship at a NASA Center to further develop aeronautics research. Last summer, as a member of the Mathematics, Engineering, Science Achievement (MESA) program, Brian developed Matlab-based tools that drastically reduced the time and effort to interpret the results of complex separation assurance simulations. He accomplished this task despite having had no prior Matlab experience. He was under the mentorship of researcher, Ms. Arwa Aweiss. The tools Brian developed are still in use in the Aviation Systems Division.

(POC: *Aisha Bowe*)

Machine-Learning Techniques Applied to Air Traffic Management Project, April 2012

NASA researcher Michael Bloem teamed up with David Hattaway of Microsoft and Nicholas Bambos, a faculty member at Stanford University, to compare machine learning algorithms that suggest miles-in-trail

air traffic management initiatives to FAA decision-makers. The Federal Aviation Administration (FAA) uses traffic management initiatives to ensure that demand for air traffic resources such as airspace and runways does not exceed the available capacity. Miles-in-trail restrictions are a type of traffic management initiative requiring that flights in a flow of air traffic crossing a certain point be separated by a designated distance in miles. This comparison of machine learning methods was based on historical data and provides some initial insights that can be applied to a joint NASA-FAA project that seeks patterns in previous traffic management initiatives to inform future air traffic management decisions. Their work was presented at the International Conference of Research in Air Transportation conference that was held in Berkeley, CA in May 2012.

(POC: *Michael Bloem*)

SFO Stratus GDP Model Assessment Begins, May 2012

The operational assessment of a model that calculates key Ground Delay Program (GDP) parameters (e.g., GDP end time, scope and rate) for San Francisco International Airport (SFO) began in May. More GDPs are implemented at SFO than any other airport in the United States because of the impact of the marine stratus layer. Mosaic ATM conducted a training session at the Oakland Air Route Traffic Control Center on April 25 and a second session at the National Weather Service (NWS) in Monterey on April 26 for specialists who will evaluate this tool during the 2012 stratus

season. Attendees included supervisory traffic management coordinators from Oakland Center, controllers from San Francisco tower, traffic management coordinators from the FAA's Air Traffic Control System Command Center (ATCSCC), and meteorologists from the Central Weather Service Unit at Oakland Center and the NWS in Monterey. These personnel work with the ATCSCC to implement air traffic initiatives so similar training has been provided to the ATCSCC. The evaluation period is May 15 through October 15, 2012.

This activity is a follow-on to the shadow mode assessment that took place from June 1 through October 15, 2011. The team supporting this operational assessment will include personnel from the FAA, NASA, Mosaic ATM, MIT Lincoln Laboratory and the NWS.

(POC: Shon Grabbe)

NASA and FAA Begin PDRC Field Evaluation, May 2012

NASA and the Federal Aviation Administration (FAA) launched the spring 2012 field evaluation of the Precision Departure Release Capability (PDRC) tool. PDRC will aid in improving tactical departure operations by enabling the automated exchange of surface scheduling information to en route tactical departure scheduling systems. Objectives for this field evaluation are to assess system performance and quantify the various contributors to scheduling uncertainty. These objectives will be accomplished as FAA Traffic Management Coordinators (TMCs) from Fort Worth En route Center, and Dallas/Fort Worth TRACON and Towers,

use PDRC to schedule at least 100 actual departures subject to traffic management restrictions. During the first week of evaluation, NASA researchers worked with the FAA TMCs to conduct practice runs of PDRC scheduling and to finalize the test configuration and procedures. Additionally, TMCs have developed innovative uses of PDRC technology that will lead to updates to the Concept of Operations.

(POC: Shawn Engelland)

SARDA Simulation, May 2012

The Spot and Runway Departure Advisor (SARDA) human-in-the-loop (HITL) simulation successfully completed three weeks of testing at the FutureFlight Central tower simulation facility at NASA's Ames Research Center. SARDA is an integrated decision support tool for tower controllers and airline ramp operators to enhance the efficiency of surface traffic and reduce fuel consumption. In the simulation, SARDA provided tactical advisories to the tower controllers to manage surface traffic more efficiently by optimally scheduling aircraft releases from spots, and by sequencing runway operations including takeoffs and runway crossings to maximize throughput and minimize system delay. The tool also provided gate push-back times to airlines, which allowed the ramp operators to hold departure aircraft at their gates for a specific amount of time and reduce delays in the runway queue. The objective of the simulation was to evaluate performance of the SARDA tool, including efficiency, throughput and predictability. Human factors metrics, includ-

ing controller workload and situation awareness, were also measured during the simulation. A total of 48 runs were conducted enabling data collection for both performance and human factors metrics. Both baseline and advisory scenarios with two levels of traffic density for the east side of Dallas/Fort Worth International Airport (DFW) operations were simulated. The controller advisories, for Ground and Local controllers, were displayed on Electronic Flight Strips using touch screen interactive technology. A total of six retired DFW tower controllers participated in the simulation.

(POC: Yoon Jung)

Air/Ground Function Allocation Simulation in AOL, May 2012

The Airspace Operations Lab (AOL) of the Human Systems Integration Division conducted a human-in-the-loop simulation to investigate new function allocations for separation assurance in air traffic control. This simulation involved more than 30 participants, including current airline pilots, general aviation pilots, and retired FAA air traffic controllers. This simulation is part of a series of simulations conducted in close cooperation with the Air Traffic Operations Lab (ATOL) at NASA's Langley Research Center to investigate the feasibility of distributing the responsibility for separating aircraft between the ground controller and the flight deck and their respective automated systems. The simulation tested an array of NASA-developed tools designed to assist controllers and pilots in managing mixed operations at air traffic levels that far exceed

today's capacity in order to meet the demands of NextGen. A two-week experiment that will also include current FAA controllers is planned for later this year.

(POC: Thomas Prevot)

FAA Experts and NASA Researchers Collaborate on OASIS Design, May 2012

NASA researchers met with FAA subject matter experts (SMEs) at Ames Research Center to elicit their guidance on the design of the Operational Airspace Sectorization Integrated System (OASIS), a major development activity of the Dynamic Airspace Configuration (DAC) research focus area. OASIS assists Area Supervisors in their planning of sector combine/decombine operations as well as opening/closing of Data-side (D-side) control positions; these advisory solutions are tailored to the predicted traffic demand over the next few hours. Ten SMEs with many years of experience at four different Air Route Traffic Control Centers (ARTCCs) participated in this design meeting. Their technical exchange with NASA researchers provided numerous operational insights and suggestions for enhancing the OASIS algorithm and user interface. They also assisted in the planning of the OASIS HITL simulation scheduled for November 2012. This design meeting and the upcoming HITL simulation are key milestones along the path to a field evaluation of OASIS at the Cleveland ARTCC in the fall of 2013.

(POC: Karl Bilimoria)

SPO Planning Meeting, May 2012

A Single Pilot Operations (SPO) meeting was conducted to identify major research areas of interest and required effort, including analysis and simulation needs, for the SPO research plan. This technical interchange focused on exploring the challenges, feasibility and practicality of single pilot operations. Attendees did not assume that single pilot operations are feasible or desirable, but rather focused on identifying the considerations that must be explored to make that determination. The goal of the meeting was to support a rich dialogue that will ultimately lead to clear research issues that will, in turn, inform future NASA research and development in this area. The meeting was well-attended by government and industry personnel. Proceedings of the meeting are available for download at <http://human-factors.arc.nasa.gov/groups/FDDRL/SPO/agenda.php>

(POC: Parimal Kopardekar)

Interchange with FAA on EDA Deployment and Trajectory Prediction, June 2012

Technical leads from the FAA Time-Based Flow Management (TBFM) Program, responsible for deployment decisions concerning arrival-metering automation, met with NASA Ames researchers regarding the Efficient Descent Advisor (EDA) and trajectory predictions in arrival automation.

The FAA took delivery of EDA earlier this year, and the TBFM group is currently planning how best to begin deploying EDA as a tool for controlling to Traffic Management Advisor (TMA) arrival schedules in

a fuel-efficient manner. Current FAA plans call for the deployment of an initial EDA capability by 2014 (full deployment in ~2020) that produces automated speed advisories only; i.e., no path-stretch advisories. In anticipation of the FAA's initial deployment needs, a simplified version of EDA, called "EDA Lite," has been developed in the NASA research software baseline. This prototype was demonstrated to the FAA visitors to show how controllers could use a simplified version of EDA that blends automated speed advisories with manual path adjustments to absorb large amounts of delay when needed. It was further shown how the added flexibility of EDA Lite might allow controllers to steer around convective weather during metering operations.

Discussions were also held on the more general subject of improving trajectory predictions in arrival automation and, in particular, how the automated downlink of parameters such as predicted Top of Descent, weight, winds and pilot-preferred speed profile could substantially improve trajectory-prediction accuracy in the arrival domain. NASA is currently engaged in the Trajectory Data Exchange (TDX) activity with Boeing, exploring how current airborne equipment and datalink services might be leveraged to provide airborne parameters on a routine basis for improving trajectory prediction and controller situational awareness.

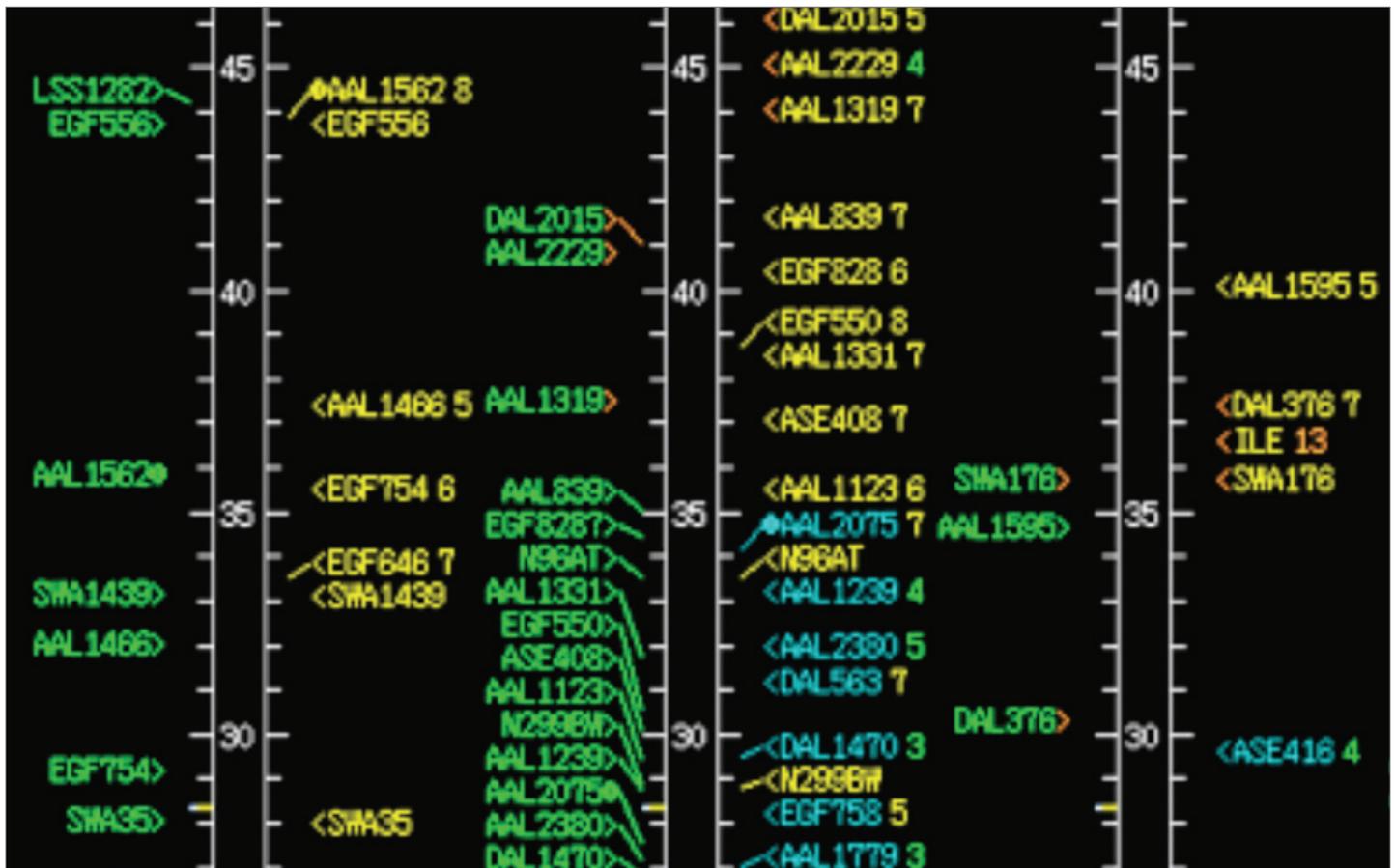
The FAA visitors showed considerable interest in EDA Lite as a stepping stone towards a full EDA deployment. They also expressed their desire to stay informed of NASA's progress with TDX.

(POC: Rich Coppenger)

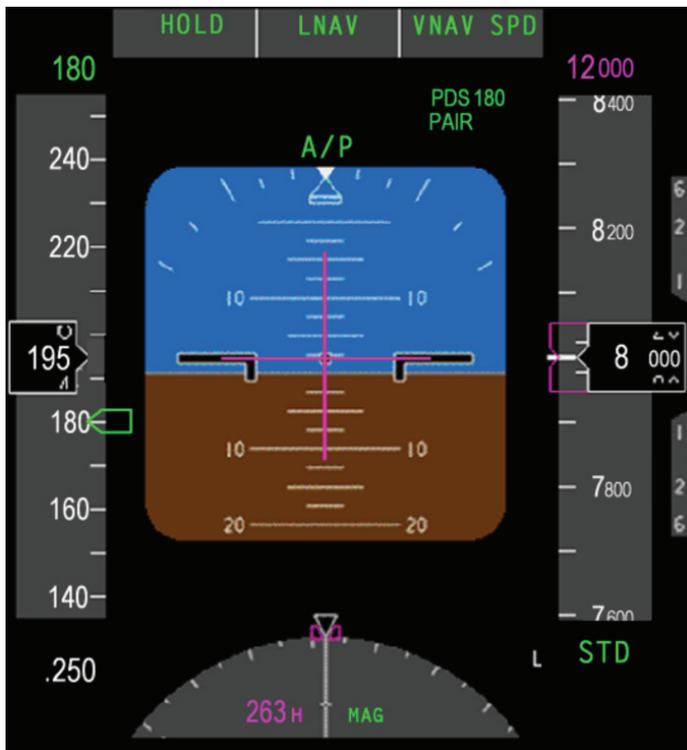
FIAT Simulation Initial Integration Completed, June 2012

The Fully Integrated ATD-1 Technology (FIAT) team tested the initial integration of the Terminal Precision Scheduling and Spacing (TAPSS) system and the Flight Deck Interval Management (FIM) technology in the Air Traffic Control lab. The objective of the FIAT simulation is to validate the system performance of the Research Traffic Management Advisor (rTMA) software, which will be used for the first Air Traffic Management

Technology Demonstration (ATD-1). ATD-1 combines advanced time-based scheduling in terminal airspace, controller managed spacing tools, and FIM to achieve sustained fuel efficient operations during periods of high traffic demand. These activities are aimed at accelerating airspace technology transition in general, and Automated Dependent Surveillance-Broadcast (ADS-B) technology adoption in particular. The integrated TAPSS and FIM system was evaluated using the LAX airspace, under a mixed Area Navigation (RNAV)



The Traffic Management Advisor (TMA) will determine an arrival schedule along advanced RNAV arrival routes for safe, orderly, and expeditious flow of traffic in the terminal area.



Flight Deck Interval Management (FIM) tools aboard the aircraft will enable flight crews to precisely space their aircraft relative to others to achieve ideal spacing.

routing infrastructure and saturated traffic demand levels. NASA Ames and Langley experts supported the initial integration. Controllers from Los Angeles Center, Southern California TRACON and two pilots contributed to validating and refining the concept of operations, procedures, symbology and phraseology to handle the controller and pilot interactions in a mixed equipage environment. The team completed a plan for a series of HITL simulations that will support ATD-1. (POC: Jane Thippavong)

Controller-Managed Spacing Simulation Completed, June 2012

The third in a series of Airspace Operations Lab (AOL) simulations conducted this year in support of ATD-1 was successfully completed. The simulation in the AOL exercised laboratory prototypes of all three promising NASA technologies that comprise the integrated ATD-1 arrival solution: the Traffic Management Advisor with Terminal Metering (TMA-TM) developed in the NASA Ames Aviation Systems division; FIM, developed at NASA Langley Research Center; and Controller-Managed Spacing (CMS) tools developed in the NASA Ames Human Systems Integration Division's AOL. The simulation focused on refining the CMS tools and ATD-1 air/ground operations, and used Dallas/Fort Worth airport arrival flows that included a mix of FIM-equipped and non-FIM-equipped aircraft. Participants included four en-route and six terminal-area air traffic controllers with DFW experience, as well as twelve multi-aircraft and eight single-aircraft pilots. The results of the experiment are expected to provide additional insights into automation and operational concept efficacy, and to inform plans for integrated ATD-1 simulations scheduled for FY13.

(POCs: Todd Callantine, Tom Prevot)

SAIE Project Scientist Leads International Symposium Workshop, June 2012

Dr. Natalia Alexandrov conducted a workshop at the Third International Air Transport and Operations

Symposium and the 2012 Complex World Seminar, Delft, the Netherlands. The workshop centered on the aspects of complexity related to making a case for new technology implementation to participants of the air transportation system, such as airlines, and to address the difficulty in modernization of air transportation. Following an introductory presentation, a lively discussion took place. Opinions among the participants were split: one group maintained that air transportation modernization, if needed, would occur strictly subject to market dynamics; the other, larger, group felt that regulation would be required for the benefit of both the system and its users. The participants' comments have been recorded, and a summary is available from n.alexandrov@nasa.gov. Alexandrov also gave a presentation during the Symposium, titled "Control of Future Air Traffic Systems via Complexity Bound Management."

(POC: Natalia Alexandrov)

Facility Experiment Review Completed for Upcoming ATD-1 Simulation, June 2012

The Facility Experiment Review for the Interval Management for the Near-Term Operations Validation of Acceptability (IM-NOVA) simulation was successfully completed. Data collection is scheduled to begin July 31 and continue through the end of August.

(POC: Jennifer Murdoch)

Surface Conflict Detection and Resolution NRA Completed, June 2012

The Optimal Synthesis NASA Research Announcement (NRA) on surface conflict detection and resolution was completed, including delivery of final presentation and documentation.

(POC: Seth Kurasaki)

Stochastic Modeling NRA Award, June 2010

Boeing was awarded a NASA Research Announcement (NRA) for the Stochastic Modeling of Arrival Time Accuracy and Transit Time Range for NextGen Operations in Super Dense Airspace. Under this NRA, Boeing will develop a range of stochastic models of arrival time accuracy and feasible transit time range for mixed-equipment NextGen operations in the terminal area, and investigate the effect of the fidelity of these uncertainty models on time-based scheduling performance.

(POC: Mike Guminsky)

PDRC RTP Available, June 2012

The Precision Departure Release Capability (PDRC) team announces the availability of the recent PDRC research transition product (RTP), a technology transfer the NASA/FAA Integrated Arrival Departure/Surface Research Transition Team began coordinating in 2009. Over the last six months, NASA/FAA coordination has intensified with the PDRC team meeting

with TBFM and TFDm research product recipients on a monthly basis. These inter-agency coordination efforts have helped the NASA team develop high-quality deliverables that address FAA needs. Several more PDRC products will be transitioned from NASA to FAA during the next two-and-a-half years.

The PDRC RTP consists of these five documents:

1. PDRC-IADS Concept of Operations, version 2.0, 30 Jun 2012.
2. PDRC-IADS Technology Description, version 1.0, 30 Jun 2012.
3. PDRC-IADS Research Notebook, version 1.0, 30 Jun 2012.
4. Engelland, S.A. and Capps, A., “Trajectory-Based Takeoff Time Predictions Applied to Tactical Departure Scheduling: Concept Description,

System Design, and Initial Observations,” AIAA-2011-6875, 11th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, Virginia Beach, VA, 20-22 Sep. 2011.

<http://www.aviationsystemsdivision.arc.nasa.gov/publications/2011/AIAA-2011-6875.pdf>

5. Capps, A. and Engelland, S.A., “Characterization of Tactical Departure Scheduling in the National Airspace System,” AIAA-2011-6835, 11th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, Virginia Beach, VA, 20-22 Sep. 2011.

<http://www.aviationsystemsdivision.arc.nasa.gov/publications/2011/AIAA-2011-6835.pdf>

(POC: Shawn Engelland)

Recent/Upcoming ASP Events

July 9–20	T-TSAFE Simulation #3, NASA Ames
July 10–12	ATD-1 FY13 Simulation Planning Meeting
July 30–August 10	Functional Allocation HITL Simulation, NASA Ames
July 31–August 31	IM-NOVA Simulation
August 29	ATD-1 Industry Day, NASA Langley
Sep 10–14	Joint NASA REACT-2/FAA TSS Simulation, NASA Ames
Oct 15–19	Data Collection Simulation for Version 1.0 of ATD-1, NASA Ames
Oct 29–Nov 9	OASIS HITL Simulation, NASA Ames
Nov 12–16	ATD-1 Integrated System Check
April 30–May 3, 2013	ASP Industry Day and Technical Interchange Meeting, NASA Ames



SAVE THE DATE
april 30–may 3, 2013

Airspace Systems Program
FY2013 Industry Day and
Technical Interchange Meeting

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Mountain View, CA

National Aeronautics and Space Administration

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